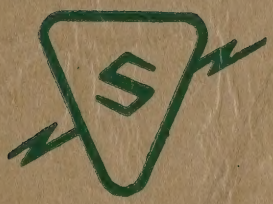
SYLVANIA
TUBE TESTERS

TYPES 219 AND 220

OPERATING MANUAL



SYLVANIA ELECTRIC PRODUCTS INC.

Price $1.00

OPERATING MANUAL

SYLVANIA TUBE TESTERS

TYPES 219 AND 220

SYLVANIA ELECTRIC PRODUCTS INC.
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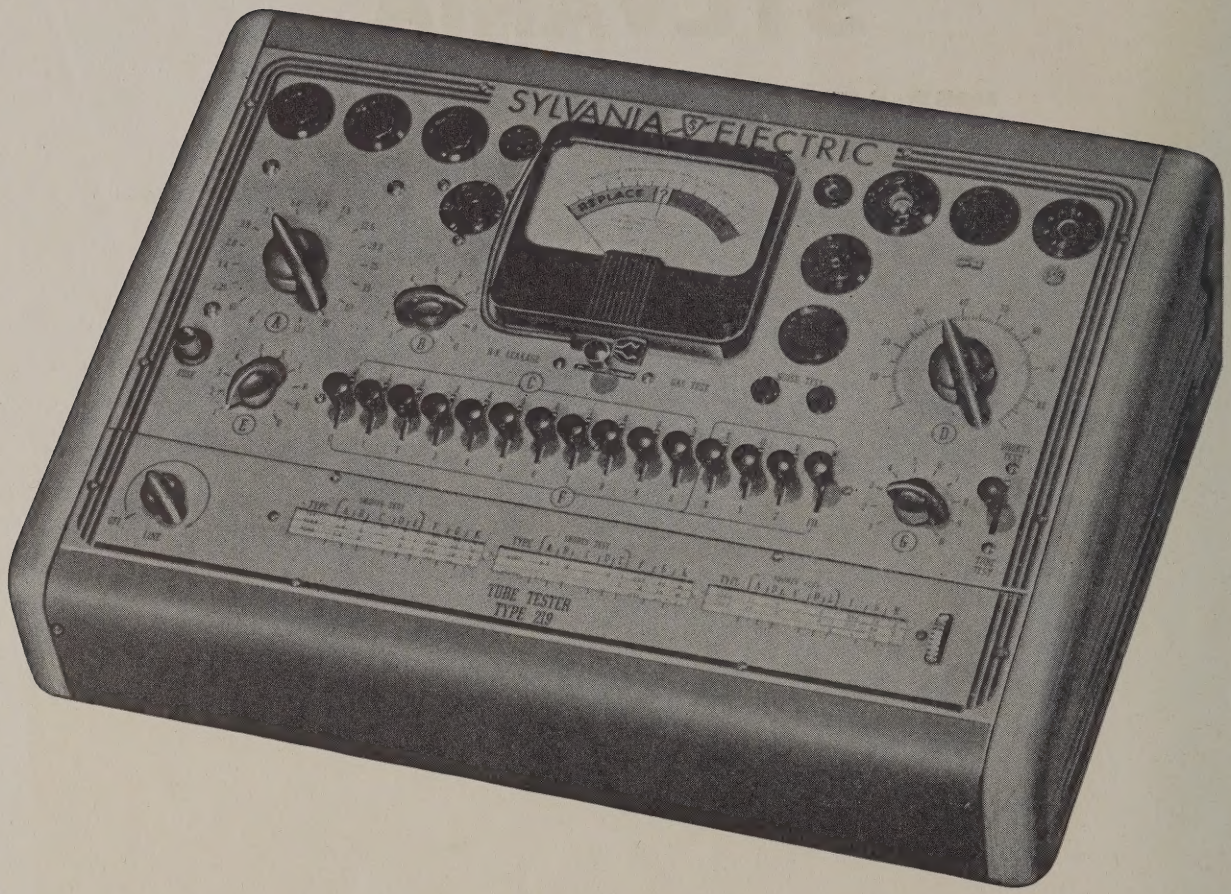

SYLVANIA TUBE TESTER
TYPE 219

SYLVANIA TUBE TESTERS TYPES 219 AND 220

SYLVANIA TUBE TESTER TYPE 220
A COMPANION INSTRUMENT FOR THE FAMOUS SYLVANIA POLYMETER AND 5" OSCILLOSCOPE
BRIEF OPERATING INSTRUCTIONS
SYLVANIA ELECTRIC

SYLVANIA TUBE TESTER
TYPE 220

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GENERAL DESCRIPTION

The Sylvania Tube Testers Types 219 and 220 are intended for use by the Radio Serviceman and others to determine the condition of any commonly encountered radio receiving tubes, and of many low-power transmitting and industrial tubes, regardless of basing. The circuit used applies properly proportioned, self-rectified voltages to the tube under test, and the "condition" indicated on the meter is a composite of transconductance and emission. The reading on a power type tube is predominantly influenced by the emission capability of the tube's cathode element, while the reading on a high gain, low power tube is predominantly influenced by its mutual conductance.

Settings are made up from average readings taken on several current production tubes of each type, which have passed production tests. The average indication obtained from the sample tubes is set as 100 on the meter scale, and the tubes which read between 70 and 130 are in general within tolerances of composite characteristic variations. The probability of being within all tolerances is greatly increased if the tube reads between 80 and 120. If it reads below 70 it is definitely questionable, and if above 130 it is either gassy or is an exceptionally "hot" tube. Many tubes outside of these limits will operate satisfactorily in some circuits, but will cause trouble in others. Some radio receivers, on the other hand, are so designed that only tubes very close to 100 will operate satisfactorily.

Short circuits, or excessive leakage between tube elements, will be indicated directly on the meter, using an exclusive Sylvania circuit. Leakage of resistance less than 250,000 ohms will cause the meter to indicate "REPLACE". The potentials applied to the tube under test, to obtain this reading, never exceed 50 volts rms. This is, furthermore, a very high impedance circuit, so that if this voltage is accidentally applied to delicate filaments, they will not be damaged. The test voltage is applied contrary to the conducting direction of the tube, so that conduction currents will not show up as leakage. When the test is applied between the cathode and the other elements, however, conduction will occur until the "h-k leakage" switch is thrown. This switch reverses the polarity of the test and removes all elements except the heater and cathode, so that only heater-cathode leakage will be read on the meter.

Only heater (or filament) voltage is applied to the tube under test, until the TEST switch is thrown to the TUBE TEST position. This avoids the possibility of the tube running with screen voltage and not plate voltage applied, and minimizes the chance of the tube being damaged by testing for an excessive period of time.

With the TEST switch in the TUBE TEST position, the GAS switch may be thrown, to open the grid circuit of the tube, and thus obtain an indication on the meter of whether or not the tube is excessively gassy. The greater the *drop* in the reading, the better the tube is for gas and secondary emission. In most cases an acceptable tube should drop *below* the half-scale point on the meter. On power tubes, if the reading stays the same or increases when the GAS switch is thrown, the tube is excessively gassy, or has an open grid.

The meter is illuminated for easy reading in poor light, and to act as an "on" indicator.

Due to the sensitivity of the shorts and leakage test, rapid intermittents of high resistance, which would cause noise in a set, will show up as more or less needle jump as the tube under test is tapped while this test is being applied. The "NOISE TEST" jacks may be connected to an amplifier or receiver to give audible indication of a noisy tube.

QUICK REFERENCE DATA

1. Power line requirements: 105-125 volts, 50-60 cycles. Uses 37 watts at 117 volts, with no tube under test.
2. Tube complement:
   One SYLVANIA Type 6C4, line and leakage indicator.
3. Basic Circuit:
   Composite transconductance and emission. Free point, direct indicating switching. Proportional self-rectified voltages applied to all elements of the tube under test, with selected ac signal on grid. Special heater-cathode leakage, shorts, gas, and filament continuity tests provided.
   Precision components.
4. Mechanical features:
   High speed, smooth running roller chart. Illuminated meter. Panel fuse. Modern styling.
5. Cabinet size:
   16 15/16" x 11 3/16" x 6".
6. Weight:
   Counter (Model 219): 18½ pounds.
   Portable (Model 220): 18½ pounds.
7. Service:
   See list of authorized Sylvania Service Stations on page 13 of this Manual.

Settings to test new tube types are brought to Sylvania test equipment users in the Sylvania News. Complete new roller charts are made available from time to time.

OPERATING INSTRUCTIONS

1. *General.*
   A. *Line Voltage:*
      This tube tester is designed to operate on a line of 50-60 cycles ac, 100 to 125 volts, only. Any other line voltage or frequency will result in inaccurate tests, or even damage to the equipment or to the tube under test. It is advisable to allow the 6C4 tube in the tester to warm up by leaving the unit

turned on for about 30 seconds before making any tests. This insures more accurate results.

B. *Switching:*

Danger of short circuits, improperly applied voltages, and accidental tube damage is minimized by the design of the tube tester. However, the settings should be carefully made as given on the chart, and checked before making a test. ALWAYS double check the A switch position before inserting a tube for test, so that excessive filament or heater voltage will not be applied. Only filament or heater voltage is applied, until the test switch is put in the TUBE TEST position. However, until you are quite familiar with all the functions of the tester, it is advisable to double check all settings before testing.

C. *Fuse Protection:*

Excessive overloads or shorted tubes may cause the fuse to blow. It should be replaced by a type 3AG, 1 ampere fuse.

D. *Roller Chart:*

The roller chart sub-panel may be removed for addition of new settings or to install a new roller chart, without interfering with the main panel. Simply remove the screws holding it in place and take off the knob of the LINE control switch, and the small panel and roller chart assembly may be lifted out without disturbing any wiring. (See instructions at bottom of roller chart).

2. *Operation.*

A. Place all levers in center (neutral) position.

B. Turn tester on by turning LINE switch to the right.

C. Rotate roller chart to type number of the tube to be tested.

D. Set A, B, C, D and E switches *only,* to the positions indicated on the roller chart. THE REST OF THE SETTINGS SHOULD NOT BE MADE UNTIL AFTER THE SHORTS, FILAMENT, AND LEAKAGE TESTS ARE FINISHED. Otherwise, no readings could be obtained for these tests.

E. Insert tube in proper socket. Adjust LINE tap switch so that meter reads in exact center of scale.

F. Pull FIL lever down to FIL position. If the tube is *not* burned out, the meter needle will move up into the green GOOD part of the scale. If the tube *is* burned out, the meter needle will remain at the center position.

G. Now check the heater-to-cathode leakage of the tube *(heater types only)* by moving the G switch to the position shown on the roller chart under the K column. Move the H-K LEAKAGE lever to the LEFT. Now move the TEST lever up to the SHORTS position. The meter will read somewhere in the green GOOD region if heater-to-cathode leakage is not excessive.

H. Now check for shorts and leakage by holding the TEST lever in the SHORTS position, and rotate the G switch to all the other positions. The meter will always read in the green GOOD region if shorts or excessive leakage do not exist. The shorted elements are directly indicated by the position of the G switch when the short is observed. The tube may be tapped in each G switch position to check for intermittent shorts. If the meter needle flicks when the tube is tapped, it is probably noisy.

NOTE: When making shorts tests on cathode type tubes, a SHORT will be indicated when the G switch is on the position indicated under K on the roller chart, due to conduction. To obtain a true indication of leakage on this position, use the H-K LEAKAGE switch as indicated in paragraph G.

I. Set the F levers and the G switch as indicated on the roller chart, and move the TEST lever to the TUBE TEST position. This will give a reading of the composite transconductance and emission. (See APPLICATIONS). Note that T, U, V, W, X, and Y positions are shown under F on the chart.

J. While holding the TEST lever down in the TUBE TEST position, move the GAS TEST lever to the *right.** If the tube is very gassy or has an open grid, the meter needle will not drop, and may even read slightly higher. Such a tube should be rejected. On power tubes the needle will drop a noticeable amount on a good tube. However, when testing an rf pentode or converter or similar tube, the reading should drop down well below mid-scale if the tube is good.

*NOTE: This test does *not* apply to diodes.

K. Return all levers to central position, and set up all other tests given on the roller chart for the tube under test.

L. *Special Tube Types:*

1. Tests on ballast tubes are not carried beyond the FIL test, as continuity is the only characteristic that has to be measured.
2. To test long lead circular header sub-miniature types, the leads should be inserted in the circular sub-miniature socket in rotation, counting socket points from right to left, viewed from the top of the panel. If there is a red dot on the tube, it should be to the left as the tube is inserted.
3. Tapped heater rectifiers and double connection tubes usually have two or more tests. This is to check continuity of all leads.

4. Transmitting types, in many cases, can be tested on the Sylvania tube testers. Some are listed on the roller chart, and others will appear from time to time in the Sylvania News.
5. New settings will appear in Sylvania News and in Howard W. Sams Photofacts for types added to the renewal availability list. Although the simple switching identification method used on the Sylvania Tube Testers makes it possible for the Serviceman to make up his own settings, it is advisable to check these with our Engineering Department before placing too much dependence upon them, because of the chance of the particular tube not being representative of the average.

3. *Functions of Controls.*
   A. The A switch selects the filament or heater voltage.
   B. The B switch applies one side of the filament or heater voltage to the selected socket point.
   C. Switches numbered from 1 to 9, when thrown to the C position, connect the corresponding socket point to a similary numbered contact on the E switch.
   D. The D potentiometer shunts the meter so that it will read in the desired portion of the scale.
   E. The E switch is intended to connect the socket point selected by C, to the filament return circuit. The E switch will pick up only one point, the one to which it is set, in this manner. Other points connected to the other contacts on the E switch by the C switch are therefore open circuited.
   F. Levers numbered from 1 to 9, when thrown to the F position, apply the grid and screen grid voltages to the socket points corresponding to the number of the switch. The lowest numbered switch will apply the grid signal, and will automatically reverse the circuit so that the next highest numbered switch will apply the screen voltage to the socket point corresponding to the switch. If the basing of the tube under test calls for the screen voltage to be on a pin with a lower number than the grid pin, switch O must be thrown to the F position to reverse the circuit.

      The T, U, V, W, X, Y, and Z switches choose the proper fixed meter shunts, plate loads, and plate and screen potentials which will be applied when the test switch is thrown. The S switch applies varying grid signal and plate voltages.
   G. The G switch performs the double function of connecting together all socket points not selected by the other switches and returning them to ground—with the exception of the one point selected by this switch. The plate voltage is applied to this selected point when the tube is being tested for composite emission and transconductance. When shorts tests are being made, the shorts test is applied between the point selected by the G switch, and all other elements.
   H. The lever under the meter, when in the GAS TEST position, opens the grid circuit of the tube under test. When thrown to H-K LEAKAGE position, it reverses the direction of application of the shorts test voltage (to avoid conduction errors), and removes all elements from the circuit except the heater and the cathode.
   I. The LINE tap switch chooses the proper tap for the available line voltage.
   J. The roller chart is of improved rapid and smooth-running design. Turn to the tube type to be tested, and set up the tube tester accordingly. Be sure to make *all* tests indicated for each type of tube tested. If any one test shows the tube bad, it should be replaced. When a dash (—) is indicated in any column, it means that the lever switches referred to by that column should all remain in neutral (center) position.

      New roller charts will be available at a nominal charge from time to time upon request, and will include all additions and corrections made up to the time they are issued. Address all requests for charts to Sylvania Electric Products, Inc., Advertising Production Dept., Emporium, Pa. Watch Sylvania News for announcement of these charts, and for other information on Sylvania test equipment.

4. *Sockets and Terminals.*
   A. The following sockets are provided on the main tube tester panel: Four, five, six, seven (combination large and small, and pilot lamp test), octal, lock-in, acorn, special 5-prong, noval 9-pin, miniature 7-pin, and sub-miniature circular and rectangular types. A blank socket is provided for future modernization, if required.
   B. Two pin tip jacks are provided, to which an audio amplifier or radio receiver may be connected for audible tests of tube noise, if the user desires. The sensitive shorts and leakage test, however, provides excellent indication of such faults.

APPLICATIONS

1. *What a Tube Tester Must Do.*

   There are two principal reasons for a serviceman buying a tube tester. He buys it so he can discover defective tubes among those brought in for test, or in receivers brought in for repair, and so increases

his tube sales; or perhaps he buys it primarily to help him solve difficult repair problems by accurately picking out tubes which are not serviceable, and are causing trouble in the set. Also, many tube testers are bought for the purpose of preventive maintenance—that is, it is used for regular checks on tubes so that they can be replaced before they cause actual failure of equipment.

Therefore the duty of the tube tester is to pick out tubes which will not operate properly in circuits designed for them, or which are near the borderline for such operation.

2. *The Major Characteristics of Vacuum Tubes.*

The characteristics which the tube tester must measure, or coordinate in a single measurement, are:

A. *Emission.* This characteristic is of foremost importance, as a tube is primarily an electron emitting device, and if insufficient electrons are emitted from the cathode, it cannot work under all the conditions it is expected to. The symbol for emission is Is, and is measured under conditions which draw practically all available electrons from the cathode. Poor emission results from faulty cathodes, excessive plate current, or may be caused by low heater voltage. It shows up as generally decreased performance, particularly in oscillators, rectifiers, or in circuits where high irregular peak currents must be handled.

B. *Transconductance.* This characteristic is the measure of the change in current to any one element of a tube under test, as the voltage applied to any other element is varied. Mutual Conductance is a special case, which refers specifically to the change in plate current resulting from a given change in control grid voltage. The symbol for Transconductance is G, and for Mutual Conductance is Gm. Transconductance is important in that it is a measure of effectiveness of the tube as an amplifier or control device. It is largely determined by the geometry of the tube elements. The Sylvania Composite Transconductance and Emission test applies predetermined voltages to all elements, and applies an actual AC signal to the control grid, thus introducing a dynamic mutual conductance factor which is a summation of the relative mutual conductance over a considerable part of the operating curve. The resultant plate current thus furnishes a composite indication of the transconductance between all elements and the plate. Furthermore, there is sufficient current drawn from the tube in all tests so that if the emission is down it will show bad, regardless of the other characteristics.

It can be seen that some tubes rejected by the Sylvania Tube Tester type 220 may function temporarily in circuits which do not require them to furnish appreciable current. However, such tubes should be replaced as preventive maintenance.

C. *Life.* The condition of the tube emitter is an important factor in its life expectancy. The Sylvania Tester requires enough cathode current for a test of "good" to enable the operator to determine the tubes quality without necessitating a reduced heater voltage test.

3. *Characteristics Which Can Be Tested Individually Are:*

A. *Gas.* When the vacuum inside the tube is imperfect, ions are formed, which decrease the effective of grid bias, and cause high, erratic space currents. A very gassy tube sometimes begins to behave like a thyratron, where the grid loses all control after the tube has fired (when there is DC on the plate). Gas further causes loading in the grid circuit of the tube. The Sylvania Tube Tester Type 220 uses the proven "grid shift" method of gas testing, which takes advantage of the fact that a large increase in resistance in the grid circuit and simultaneous removal of the grid signal will cause a large decrease in plate current in a non-gassy tube, while the gassy tube will still draw about the same, or even more plate current. This is because the increased grid resistance will result in a higher positive grid voltage, due to flow of gas current.

Gas in a tube can result from leakage through glass seals, excessive current requirements in the circuit which cause the elements to run very hot, or gradual releasing of occluded gas in the tube elements with age.

B. *Leakage and Shorts.* Improper leakage paths across micas, glass, or other insulating material within the tube, may cause circuit loading and improper bias conditions. Such leakage paths may result from "getter" material depositing in thin film on micas, cathode sputtering, or similar circumstances. The Sylvania Tube Tester Type 220 utilizes an exclusive, very sensitive test for leakage, which is adjusted to show a tube as defective when the leakage is 250,000 ohms or less, but which has a continuous scale. Very high leakage resistance tubes may be selected for special applications if desired. Often leakage can be reduced by thoroughly cleaning the base of the tube between pins.

If any two elements within the tube are in contact, the leakage will of course be very great, and the indicator needle will drop to zero. Such shorts may result from bowed side-rods, peeled off heater insulation, sagging filaments, particles of foreign material in the tube, etc. The sensitivity of the leakage test is sufficient to show easily noticeable

movement of the needle when quick intermittent shorts are present, if the tube is tapped while testing for shorts. Such shorts are the cause of noise and other intermittent set behavior.

C. *Open Elements.* There are a great many very small spot welds within a tube. It sometimes happens that these welds become open due to shock in shipping or handling, or due to thermal expansion within the tube. The latter of course would not appear until the tube is thoroughly warmed up. The circuit used in the Sylvania Type 220 will immediately indicate an open circuit as a much reduced or zero reading on the meter. There is one exception which must be guarded against, and that is the case of the low mu power tube. Here the steady state plate current is so high (if the emission is good) that disconnecting the control grid will sometimes leave the indication up in the green part of the scale, although usually this indication will waver and be unsteady due to accumulated grid charges. Here, however, the gas test has a valuable secondary function. If the gas test is applied to such a tube having an open grid, it is evident that no shift in plate current will occur—which is sufficient to cause rejection of the tube.

4. *Characteristics Not Specifically Included in General Purpose Tube Testers.*

A. In addition to the most important of the characteristics of a vacuum tube (those which cause operation or non-operation) there are many other characteristics which the tube manufacturer must control in production, but which are not necessarily measured in a general purpose tube tester. Actually, many of these factors automatically enter into the reading obtained on the Sylvania Tube Tester Type 220.

On the large, expensive vacuum tube bridges in the laboratory, individual readings are made of the actual current to each element of the tube. Emission is read, as well as mutual conductance, plate resistance, gas current, conversion conductance (in converters), interelectrode capacitance, heater cathode leakage, power output, distortion, noise (direct and radiated), microphonism, hum, and many special measurements. The equipment necessary to make these measurements, and to maintain test conditions exactly as required by the tube specifications, cost many thousands of dollars. In addition to these tests, the tube manufacturers maintain banks of life test racks, where samples from each lot of tubes are allowed to run under rated conditions, day and night, for hundreds of hours. No lot of tubes is released until this sample passes the life test.

5. *Effects of the Various Tube Characteristics.*

A. *Emission.* Poor emission will cause a slump in all characteristics. However, mutual conductance, and rectifier output voltage (for instance) will sometimes measure good until a load is applied, then will slump rapidly. This is like a defective dry cell battery, where the voltage looks good until some current is drawn. In a battery this is caused by poor chemical action and in a tube by lack of available electrons.

B. *Mutual conductance,* coupled with plate resistance, (Rp) indicate the maximum attainable amplification possible in the tube: Amplification Factor = GmRp. The symbol for amplification factor is the Greek letter mu, and it indicates the change in plate voltage resulting from a given change in grid voltage, with plate current kept constant. This characteristic is most important in voltage amplifier tubes. It is a complex characteristic to measure, and requires carefully controlled conditions. A tube with low mu or Gm will have low gain.

Conversion Transconductance (Gc) measures the effectiveness of a tube as a converter. It is the most complex characteristic to measure. Poor Gc results in noise or inefficient conversion.

C. *Gas.* Gas in a tube usually results in insufficient negative bias, which causes oscillation or loading in voltage amplifiers, and distortion or overheating in power tubes. A tube which has been on the shelf for a long time should be allowed to "cook" in a receiver for a couple of minutes before judging its quality. Accumulated gas will quite often clear up permanently in this manner, if all normal voltages are applied. A tube which is completely "air" may heat up without any apparent light from the heater. This is because the air conducts the heat away from the filament or heater wires, so that they cannot get hot enough to glow.

Very little gas is permissible in tubes which have high impedances in their grid circuits, such as rf pentodes. More can be tolerated in most power amplifier tubes, providing there is not excessive resistance in the grid circuit. Grid resistors in excess of the maximum recommended by the tube manufacturer should not be permitted in resistance coupled amplifiers.

D. *Heater-Cathode Leakage.* When the insulating coating applied to the heater wires in a cathode type tube becomes damaged, or contains impurities, it is possible for the resistance between the heater and cathode to decrease and cause an ac potential from the heater to appear in part on the cathode. With

an ungrounded and un-bypassed cathode, this will result in the introduction of hum into the circuit, particularly in high-gain tubes. Limits for this characteristic vary greatly, depending on the application. The heater-cathode leakage test on the Sylvania Tube Tester 220 makes it possible to select tubes which are exceptionally good for this characteristic, for critical applications like high gain audio amplifiers.

E. *Microphonism.* Measurements for microphonism must be made in special sockets, which are known to be free from the usual design faults which cause this phenomenon. Tubes should not be subject to vibration from speakers or phonograph motors, and should not be in strong magnetic fields from speakers. Microphonism causes an intermittent or sustained howl when the tube is tapped.

F. *Inter-Electrode Capacitance.* This characteristic is not measurable on general purpose tube testers, because of the small capacitances involved (of the order of a fraction of a micromicrofarad). However, it will have considerable effect on the operation of a tube in circuits involving high frequencies. This is an instance where a tube testing good on the tube tester may not function properly. Fortunately, when something has happened to a tube to make its interelectrode capacitances badly out of line, other characteristics are frequently affected, and this shows up on the tube tester.

6. *How Tube Tester Settings Are Made Up.*

A. *Reference Tubes.* All settings on the Sylvania Tube Tester Type 220 are made from readings taken on sample tubes which have passed all production tests. It is possible that these tubes will vary somewhat in characteristics, but all must be within specification limits.

Averages of readings made on all sample tubes are used to make up the settings, based on a meter reading of 100 for an "average" tube.

B. *Switch Positions.* All switches on the Sylvania Tube Tester Type 220 are numbered to correspond to the socket point to which they are connected. This makes it possible to know just what you are doing when you set up to test a tube, by referring to a basing diagram of that tube. Voltages applied and current drawn are proportioned so that an effective test is applied, without damage to the tube. Although it is possible for the serviceman to make up settings for tubes which are not provided for on the roller chart, it is not recommended, except for temporary emergency use until settings are available from the factory. New roller charts are prepared from time to time, and are available at $1.00 each from the Sylvania Advertising Dep't., Emporium, Penna. Watch Sylvania News for announcement of new charts, and for new settings.

C. The main objective of proper settings is to pick out tubes which do not come up to the original production standards. This does not necessarily mean that they will not work in *any* circuit, but does mean that for best set performance they are not to be recommended for use in circuits of proper design. Due to the constantly changing requirements imposed by set designers, the tube manufacturer is in a better position to make up the tests most likely to do the job of eliminating tubes which will not function properly in all known circuits.

D. It is obvious that a tube tester which combines tests for all characteristics into one quality test will occasionally miss—when, for instance, one characteristic is abnormally low and one abnormally high. There is the possibility of exact compensation here, but it is unlikely. Even if exact compensation should occur, there is some chance that this same compensation will take place in the circuit in which the tube is used, and the tube work properly. This brings the margin of error down quite low.

On the other hand, a tester which tests for only one main characteristic will ignore to a considerable extent other important characteristics which may be vital to proper operation of the tube. Thus it appears that the use, as references, of standard production tubes known to be good in all respects, is more reliable than depending on one characteristic only, no matter how important that characteristic may be.

MAINTENANCE

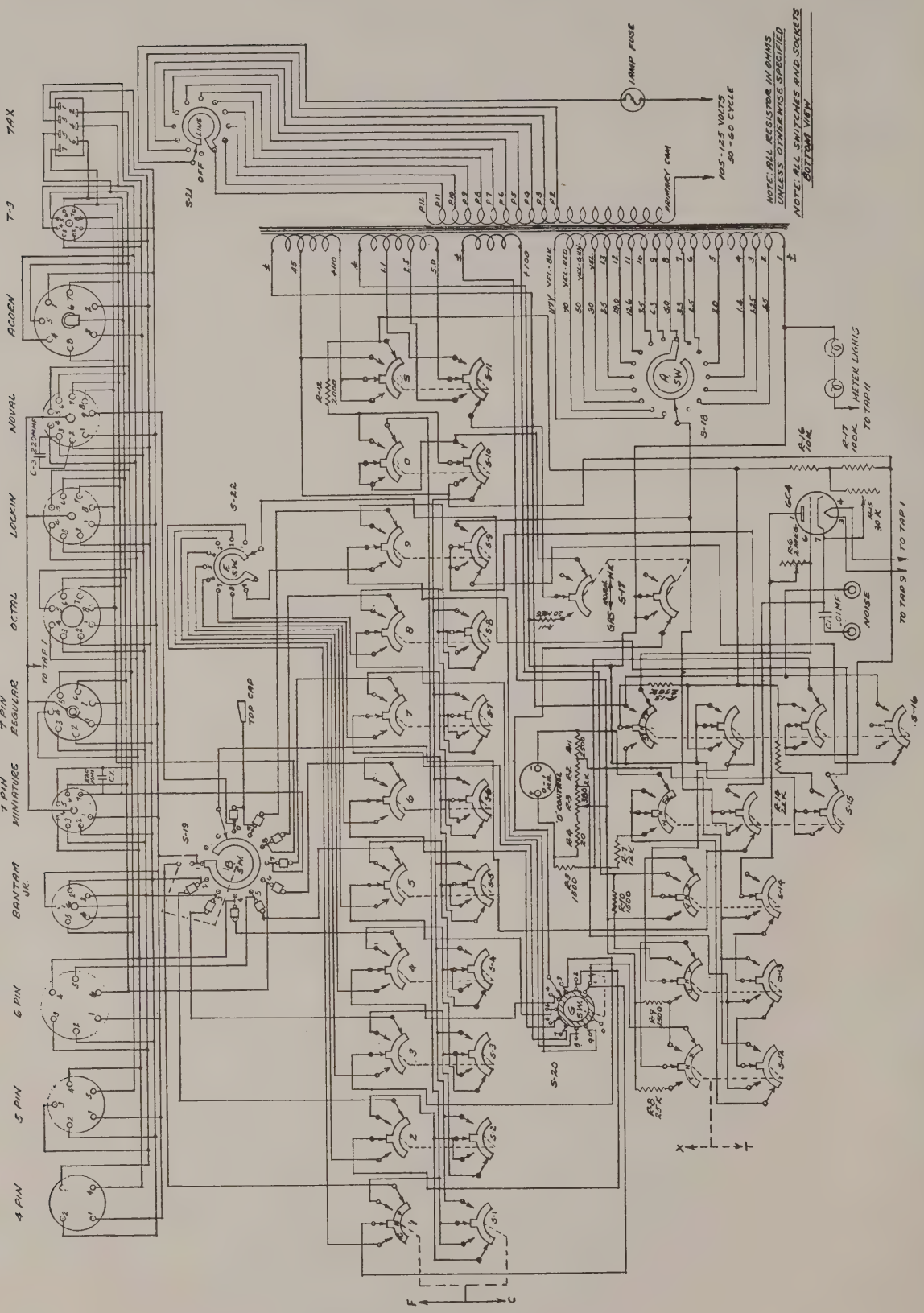
1. *Line and Shorts Test Adjustment.*

A. After several months use of the tube tester, it is advisable to re-set the line and shorts circuit to compensate for 6C4 aging and possible small shift in resistor values. The tester may be sent to the nearest Sylvania Service Station, or if an accurately measured and controlled ac source is available, the serviceman can make this adjustment according to the following procedure:

1. Remove the entire tester from the cabinet. Set the LINE switch to position 4 (do not count the OFF position).
2. Set the ac supply to exactly 117.5 volts.
3. Set R-6 so that the meter needle comes exactly to the center of the scale.

4. With all C and F switches in neutral position, throw the TEST switch to SHORTS position. Adjust R-15 so that the meter on the tester reads about halfway between 130 and full scale.
5. Re-check R-6, and readjust slightly for center scale reading, if necessary. (There is some interaction between these two adjustments). Re-seal both potentiometers with lacquer.

2. *General.*
   A. After months of continual use it may be necessary to replace sockets or switches. If these are not available in the shop, they may be obtained from your nearest Sylvania Service Station.
   B. Do *not* change the position of the knob on the shaft of the D potentiometer. It may not return exactly to zero reading at the limit of rotation, but it has been set at the factory for proper tracking.



CIRCUIT DIAGRAM OF THE SYLVANIA TUBE TESTERS TYPE 219 AND 220

For service, carefully pack the COMPLETE equipment and ship it to your nearest Authorized Sylvania Service Station by prepaid express. Accompany it with a letter describing the trouble and giving the PURCHASE DATE.

AUTHORIZED SYLVANIA SERVICE STATIONS

EAST COAST STATES

Radio Television Company
723 Ponce de Leon Ave., N. E.
ATLANTA, GEORGIA
Att: Mr. G. F. Johnson

Hoffman Electronics Corp.
253 East 72nd Street
NEW YORK 21, NEW YORK
Att: Mr. J. Hoffman

CENTRAL STATES

Master Electric Service Co.
835 West Washington Blvd.
CHICAGO 7, ILLINOIS
Att: Mr. Richard Lomastro

WEST COAST STATES

Service Radio Wholesale
1357 Post Street
SAN FRANCISCO 9, CALIFORNIA
Att: Mr. Jerry Shirek

CANADA

Bayly Engineering, Ltd.
5 First Street
AJAX, ONTARIO, CANADA
Att: Mr. B. DeF. Bayly

FACTORY SERVICE STATION

Sylvania Electric Products Inc.
1221 West Third Street
WILLIAMSPORT, PENNSYLVANIA
Att: J. H. Mintzer

PARTS LIST

Symbol	Description	Rating	Tol.	Sylvania Part No.
	Bearing, gear			18064
	Block, left side (219 only)			18515
	Block, right side (219 only)			18516
	Board, mounting			18334
	Book, instruction			PN-67
	Bracket, chart			18083
	Bracket, mounting			18380
	Bumper, rubber			14511
	Cabinet (Type 220 only)			18134
	Cabinet (Type 219 only)			18559
	Cable assembly, power			13501
C-1	Capacitor, fixed paper	.01 mf	±20%	13879
C-2	Capacitor, fixed mica	220 mmf		16162
	Card, warranty			18058
	Chart, tube tester			18325
	Clip, tube contact			11933
	Connector, female contact			13449
	Envelope, contents			18055
	Extractor post, fuse			6475
	Fastener, latch (Type 220 only)			13181
	Foot, mounting (Type 220 only)			12338
F-1	Fuse, glass tube	1 amp		2422
	Gear, spur			18366
	Pinion			18075
	Grommet, rubber, ¼" hole			106
	Grommet, rubber, 11/32" hole			1959
	Gudgeon			18201
	Handle, cabinet (Type 220 only)			16940
	Hinge, butt (Type 220 only)			13141
	Knob, bar, 2¼"			16413
	Knob, bar, 1¼"			16252
	Knob, lever black			12681
	Knob, lever red			18212
I-1, I-2	Lamp, incandescent	0.15 amp		2828
M-1	Meter, milliampere	0-1 ma.		18136
	Panel (Type 220 only)			18010
	Panel (Type 219 only)			18563
*R-1	Resistor, fixed	2500 ohms, ½ W.	±1%	11927
*R-2	Resistor, fixed	2000 ohms, ½ W.	±1%	11928
R-3	Resistor, variable	380 ohms	±2%	18330
*R-4	Resistor, fixed	20 ohms, ½ W.	±1%	18164
R-5	Resistor, fixed	1500 ohms, 20 W.	±1%	18200
R-6	Resistor, variable	2 meg., ¼ W.		18364
*R-7	Resistor, fixed	12,000 ohms, ½ W.	±1%	18165
*R-8	Resistor, fixed	25,000 ohms, ½ W.	±10%	18166
R-9, R-10	Resistor, fixed	1500 ohms, 4 W	±1%	18198
R-11	Resistor, fixed	20 meg., ½ W.	±10%	7718
R-12	Resistor, fixed	2000 ohms, 4 W.	±1%	18199

Symbol	Description	Rating	Tol.	Sylvania Part No.
*R-13	Resistor, fixed	250,000 ohms, ½ W.	±1%	18168
R-14	Resistor, fixed	22,000 ohms, ½ W.	±10%	18169
R-15	Resistor, variable	30,000 ohms		18274
R-16	Resistor, fixed	10,000 ohms, ½ W.	±10%	982
R-17	Resistor, fixed	100,000 ohms, ½ W.	±10%	1024
	Roller, chart			18074
	Socket, acorn type			11884
	Socket, sub miniature (type 7AX)			18156
	Socket, sub miniature for T-3			18171
	Socket, miniature T-5½			11940
	Socket, miniature special 5 prong			11941
	Socket, noval T-6½			17571
	Socket, four prong			11934
	Socket, five prong			11935
	Socket, six prong			11936
	Socket, seven prong			11937
	Socket, octal			18155
	Socket, lock-in			18175
	Socket, miniature T-5½			18176
	Shield, T-5½ tube			18177
S-1-14	Switch, lever, positive return, 2 circ., 3 pos.			11921
S-20	Switch, rotary, special			18157
S-18	Switch, rotary, one circ., 17 pos.			18137
S-17	Switch, lever, (altered), 2 circ., 3 pos.			18369
S-22	Switch, rotary, single circ., 10 pos.			18158
S-19	Switch, rotary, special			18159
S-21	Switch, rotary, (line), single circ., 12 pos.			18735
S-16	Switch, lever (altered), 4 circ., 3 pos.			18370
	Switch, lever (altered), 3 circ., 3 pos.			18371
T-1	Transformer, power			18126
V-1	Tube, electron, Sylvania type 6C4			
	Window			18317

*Signifies matched pair

WARRANTY

Sylvania Electric Products Inc., warrants each new Tube Tester manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use, and service discloses such defect, provided the unit is delivered by the owner to a Sylvania Authorized Service Station intact, for our examination, with all transportation prepaid, within 90 days from the date of sale to original purchaser and provided such examination discloses in our judgment that it is thus defective.

This warranty does not extend to any Tube Tester which has been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation or to use in violation of instructions furnished by us, nor to units which have been repaired or altered outside of our authority, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other warranty liability.

THIS WARRANTY IS VOID UNLESS WARRANTY CARD INCLUDED WITH INSTRUMENT IS FILLED OUT COMPLETELY AND MAILED UPON INITIAL SALE OF THE INSTRUMENT BY THE DISTRIBUTOR.

This warranty applies only in the United States and its possessions and the Dominion of Canada where Sylvania maintains service establishments. In other countries, write to the International Sales Division, Sylvania Electric Products Inc., 1740 Broadway, New York 19, New York, or the local Sylvania Representative in your country.

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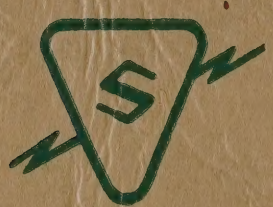
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